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CHEMISTRY.—*The polymorphic forms and thermotropic properties, of Schiff's bases derived from 3-methoxy-4-hydroxy-5-iodo-benzaldehyde.*[1] RAYMOND M. HANN, Bureau of Chemistry, Department of Agriculture. (Communicated by EDGAR T. WHERRY).

The apparent tendency of Schiff's bases[2] to form isomeric compounds,[3] differing in color, solubility, and other physical properties, has encouraged an extensive study of this class of aldehydic derivatives. These compounds differ in their major physical properties, and some show marked changes in color when recrystallized from different solvents,[4] and even from the same solvent, under varying conditions of concentration and temperature.[5]

Senier and Forster[6] state that Schiff's bases containing a hydroxyl group para to the aldehyde amine linkage are of particular interest in that they yield dimorphic forms on trituration. Senier and Shepheard[7] showed that salicylidene metatoluidine, a hydroxy anil of the Schiff base type, exhibited phototropic properties when exposed to actinic light. A little later the same author[8] demonstrated that compounds of this type also showed reversible changes in color upon

[1] Presented at the Milwaukee meeting of the American Chemical Society, September 10–14, 1923.

[2] These bases result from the equimolecular condensation of an aldehyde and a primary amine. Dimroth and Zölpritz, Ber. 35: 984. 1902.

[3] Senier and Shepheard, Journ. Chem. Soc. 95: 1944. 1909.

[4] Morgan and Jones, Journ. Soc. Chem. Ind. 42: 92T. 1923.

[5] Senier, Shepheard, and Clarke, Journ. Chem. Soc. 101: 1950. 1912.

[6] Senier and Forster, Journ. Chem. Soc. 105: 2462. 1914.

[7] Senier and Shepheard, Journ. Chem. Soc. 95: 441. 1909.

[8] Senier and Shepheard, Journ. Chem. Soc. 95: 1943. 1909.

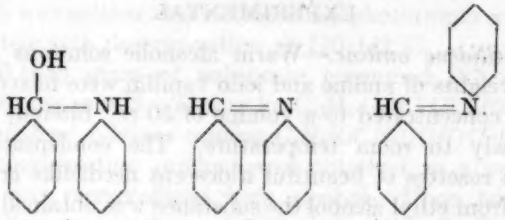
heating, a characteristic which they called thermotrophy. These authors advanced the opinion that phototropic and thermotropic changes are due to isomeric changes affecting the aggregation of molecules rather than to any intramolecular change. In an effort to obtain more definite information upon these phenomena, Senier and various co-workers have prepared and studied characteristic ortho-hydroxy α-naphthylidene,[8] salicylidene,[7] ortho-nitro benzylidene,[9] para-hydroxy benzylidene,[10] vanillidene,[11] and anisylidene[12] aryl amines. No definite relationship between the optical phenomena observed and the constitution of the compounds could be traced. It was noted, however, that the para-hydroxy benzylidene compounds were not phototropic.

The series of compounds here discussed was prepared in order to study the possible effect of the addition of a negative radical to a para-hydroxy benzaldehydic aryl amine on the phototropy and thermotropy. The aldehyde chosen for this purpose was 3-methoxy-4-hydroxy-5-iodo benzaldehyde which was readily prepared from vanillin (meta-methoxy para-hydroxy benzaldehyde) by a modification of the method of Carles.[13] It is evident that his original preparation was not pure since he reports 174°C. as the melting point of the halogen substituted aldehyde, while the pure compound melts at 180°C. Bougault and Robin have prepared the substance by an indirect method (the interaction of benzenyl-iodo-amidine and vanillin), and the melting point reported[14] is identical with that obtained during the present study.

The mechanism[15] of the condensation between equimolecular proportions of an aromatic aldehyde and an amine is now well understood. The reaction proceeds in two stages, the first resulting in the formation of an intermediate addition product (1) which generally splits off water to give the condensation product (2) which it is not unreasonable to suppose could also exist in a stereoisomeric form (3).[16]

[9] Senier and Clarke, Journ. Chem. Soc. **105**: 1917. 1914.
[10] Senier and Forster, Journ. Chem. Soc. **105**: 2462. 1914.
[11] Senier and Forster, Journ. Chem. Soc. **107**: 452. 1915.
[12] Senier and Forster, Journ. Chem. Soc. **107**: 1165. 1915.
[13] Carles, Bull. Soc. Chim. Paris **17**: 14. 1872.
[14] Bougault and Robin, Compt. rend. **172**: 452. 1921.
[15] Lowy, *et al.*, Journ. Am. Chem. Soc. **42**: 849. 1920; **43**: 346. 1921. Noyes, Journ. Am. Chem. Soc. **44**: 2558. 1922. Dimroth and Zölppritz, *loc. cit.*
[16] Lowy and King, Journ. Am. Chem. Soc. **43**: 625. 1921.

Compounds of Type 1 are obtained only rarely, although Rugheimer,[17] who obtained a series from chloral and various amines, shows that increased basicity tends toward increased stability. A summary of such derivatives is included in a paper by Raiziss and Blatt[18] who obtained addition compounds from arsephenamine and



1 2 3

aromatic aldehydes. The fact that Downey and Lowy[19] were able to form a compound of this general constitution from 2, 4-dinitrobenzaldehyde and ortho-toluidine led to an attempt to prepare a similar compound from 3-methoxy-4-hydroxy-5-iodo benzaldehyde. The desired combination was not effected, however, under the present experimental conditions.

Compounds of Type 2 and aniline, o-chloro aniline, p-chloro aniline, p-iodo aniline, p-bromo aniline, o-toluidine, m-toluidine, p-toluidine, ψ-cumidine, p-amino phenol, m-amino phenol, α-naphthylamine, β-naphthylamine and benzidine were readily obtained from 3-methoxy-4-hydroxy-5-iodo-benzaldehyde. The following amines did not react under the experimental conditions employed: 2,4 dichloro aniline, the three nitranilines, tri-bromo aniline, o-bromo aniline, and tri-nitro aniline.

With one or two exceptions the substances obtained are remarkably resistant to the action of actinic light. None of them are phototropic. Most of them show no marked thermotropic change upon exposure to heat. Since the vanillidene aryl amines studied by Senier did show marked changes upon heating, it is evident that the addition of iodine causes some fundamental change in the ability of the derivatives to undergo thermotropic transformation.

[17] Rugheimer, Ber. **39**: 1653. 1906.
[18] Raiziss and Blatt, Journ. Am. Chem. Soc. **44**: 2023. 1922.
[19] Downey and Lowy, Journ. Am. Chem. Soc. **45**: 1060. 1923.

No sign of a structurally isomeric compound (Type 3) was obtained. Brady and Dunn[20] were unable to prepare the two stereoisomeric oximes of the 5-nitro and 5-bromo meta-methoxy para-hydroxy benzaldehydes and it is possible that the occupation of the 5-position has a marked effect upon the formation of stereoisomeric forms.

EXPERIMENTAL

5-Iodo-vanillidene aniline.—Warm alcoholic solutions (100 cc.) of equivalent weights of aniline and iodo vanillin were mixed, heated for 15 minutes, concentrated to a volume of 50 cc., filtered, and allowed to cool slowly to room temperature. The condensation product separated in rosettes of beautiful iridescent needlelike crystals. Recrystallized from ethyl alcohol the substance was obtained as flattened bipyramidal crystals of a brilliant deep red color. Upon removal from solution the crystal faces rapidly lost their brilliant luster and in a period of three weeks had become completely opaque and had assumed a yellow color. When crushed the red crystals yielded an orange powder which melted to a dark red oil at 152–153°C. The substance was soluble in methyl and ethyl alcohols, acetone, and chloroform, and was apparently decomposed by boiling water. The compound was neither phototropic nor thermotropic.

Analysis: 0.1004 gram of substance consumed 2.8 cc. $\frac{N}{10}$ acid (Kjeldahl)[21] 3.91 per cent N. Theory for $C_{14}H_{12}O_2NI$ = 3.97 per cent.

HALOGEN ANILINES

5-Iodo-vanillidene o -chloro-aniline $C_6H_2\ (\overset{3}{O}CH_3)\ (\overset{4}{O}H)\ (\overset{5}{I})\ CH = NC_6H_4\ (\overset{2}{C}l)$.—The chloro aniline condensation products were prepared by adding 1.2 grams of the halogenated amine to an alcoholic solution containing 2 grams of aldehyde, concentrating to a volume of 10 cc., and cooling slowly. It was necessary to scratch the beaker vigorously to cause separation of the ortho chloro compound. Recrystallized from alcohol, the substance separated as a mass of yellow-brown crystals. These showed slight change on trituration, were not phototropic, and did not show a thermotropic change on heating. Heated in a capillary tube, the crushed crystals contracted at 138°C. and melted at 143°C. to a black tarlike mass.

[20] Brady and Dunn, Journ. Chem. Soc. 109: 667. 1916.

[21] For this and other nitrogen analyses reported in this paper the author is indebted to L. J. Jenkins of the Nitrogen Laboratory, Bureau of Chemistry.

Analysis: 0.2949 gram of substance consumed 7.1 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.37 per cent N. Theory for $C_{14}H_{11}O_2NICl$ 3.62 per cent N.

5-Iodo-vanillidene p-chloro aniline C_6H_2 ($\overset{3}{O}CH_3$) ($\overset{4}{O}H$) ($\overset{5}{I}$) $CH = NC_6H_4$ ($\overset{4}{Cl}$).—The para isomer separated from the alcoholic solution in brilliant red iridescent needles. Upon trituration an orange colored powder which was neither thermotropic nor phototropic was obtained. The anil melted with decomposition at 110–111°C.

Analysis: 0.1048 gram of substance consumed 2.7 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.61 per cent N. Theory for $C_{14}H_{11}O_2N$ I Cl 3.62 per cent N.

5-Iodo-vanillidene p-bromo aniline $C_6H_2(OCH_3)(OH)(I)CH=NC_6H_4(Br)$.—The condensation product was obtained as a yellow-brown powder and was recrystallized from alcohol. Upon trituration, it assumed a yellow green color and a characteristic metallic luster. It melted with partial decomposition to a yellow brown liquid at 108°C.

Analysis: 0.1108 gram of substance consumed 2.6 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.29 per cent N. Theory for $C_{14}H_{11}O_2N$ I Br 3.24 per cent N.

5-Iodo-vanillidene p-iodo aniline $C_6H_2(OCH_3)(OH)(I)CH=NC_6H_4(I)$.—This is similar to the corresponding bromo derivative, occurring as a yellow-brown powder, which upon trituration becomes yellow-green and shows the metallic luster exhibited by the bromo compound. It melts somewhat slowly at 98°C. to a clear light-brown liquid.

Analysis: 0.1417 gram of substance consumed 2.8 cc. $\frac{N}{10}$ acid (Kjeldahl) 2.77 per cent N. Theory for $C_{14}H_{11}O_2NI_2$ 2.92 per cent N.

Toluidines

5-Iodo-vanillidene o-toluidine C_6H_2 ($\overset{3}{O}CH_3$) ($\overset{4}{O}H$) ($\overset{5}{I}$) $CH = NC_6H_4(CH_3)$.—This condensation product was obtained by following the general directions given under the corresponding aniline compound. It was necessary to scratch the beaker vigorously to cause precipitation. Recrystallized from absolute alcohol, it was obtained as wart-like masses of light-yellow microcrystalline needles. Upon trituration a deep yellow polymorphic form was obtained. Upon heating in a capillary tube this form becomes deeper colored, but, since it fails to show a reverse color change upon cooling, it cannot be classed as thermotropic. Both forms of the substance melt at the same temperature (120-1°C.) to a dark-brown tarry mass. The substance is quite soluble in the usual organic solvents.

Analysis: 0.2130 gram of substance consumed 5.8 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.81 per cent N. Theory for $C_{15}H_{14}O_2NI$ 3.82 per cent N.

5-Iodo-vanillidene m-toluidine $C_6H_2\ (\overset{3}{OCH_3})\ (\overset{4}{OH})\ (\overset{5}{I})\ CH = NC_6H_4\ (\overset{3}{CH_3})$.—Two grams of iodo vanillin and 1.5 grams of the pure amine were dissolved in 50 cc. of alcohol and the solution was boiled vigorously for 5 minutes, after which the solution was filtered and allowed to cool slowly to room temperature. Upon standing overnight the compound separated out in granular orange-red crystals. Upon trituration a darker red form is obtained, but neither form is thermotropic or phototropic. The substance is soluble in alcohol, acetone, and chloroform. It fuses to an opaque yellow liquid at 103–4°C. which, at 145°C., clears up to a deep red oil.

Analysis: 0.2008 gram of substance consumed 5.7 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.98 per cent N. Theory for $C_{15}H_{14}O_2NI$ 3.82 per cent N.

5-Iodo-vanillidene p-toluidine $C_6H_2\ (\overset{3}{OCH_3})\ (\overset{4}{OH})\ (\overset{5}{I})\ CH = NC_6H_4\ (\overset{4}{CH_3})$.—This anil was prepared in the same manner as the isomeric compound. Boiling was necessary to complete the original solution. Upon standing overnight the anil had separated in clear brilliant golden-brown crystals. Upon vigorous trituration or heating this deep yellow form becomes nearly colorless and it does not return to its original color on cooling. Upon standing at room temperature, the deep yellow form slowly reverts to the paler form. Both varieties melt at 160–1°C.

Analysis: 0.2005 gram consumed 2.6 cc. $\frac{N}{5}$ acid (Kjeldahl) 3.63 per cent N. Theory for $C_{15}H_{14}O_2NI$ 3.82 per cent N.

Napthylamines

5-Iodo-vanillidene α-naphthylamine $C_6H_2\ (\overset{3}{OCH_3})\ (\overset{4}{OH})\ (\overset{5}{I})\ CH = NC_{10}H_7$.—A great deal of difficulty was encountered in preparing this derivative. After repeatedly obtaining heavy dark-red oils, a very dark crystalline material was obtained from the supernatant liquids remaining after precipitation of the tarry mass. This was carefully recrystallized from alcohol from which it tended to separate as an oil but was finally obtained as a yellow brown crystalline deposit. When crushed it yielded a bright yellow powder, which became much lighter in color when heated in a capillary tube. It contracted at 150°C. and, on increasing the temperature, assumed a condition of a red melt which finally decomposed at 226°C.

Analysis: 0.1824 gram of substance consumed 4.5 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.46 per cent N. Theory for $C_{18}H_{14}O_2N$ I = 3.47 per cent N.

5-Iodo-vanillidene β-napthylamine C_6H_2 $(\overset{3}{O}CH_3)$ $(\overset{4}{O}H)$ $(\overset{5}{I})$ $CH = NC_{10}H_7$.—An effort was made to obtain this compound in an isomeric form by working below 0°C., but the substance obtained at the lower temperature was identical with that prepared by the general procedure. The substance is obtained in clusters of light yellow microcrystalline needles upon recrystallization from alcohol. It is dimorphous, a deep yellow variety being produced on trituration. Exposed to the rays of actinic light, it rapidly darkens to a deep brown color but no reverse change was observed when the compound was placed in the dark over a protracted period. The anil melted at 163°C. to a clear red oil.

Analysis: 0.2738 gram of substance consumed 6.3 cc. $\frac{N}{10}$ acid 3.22 per cent N. Theory for $C_{18}H_{14}O_2N$ I = 3.47 per cent N.

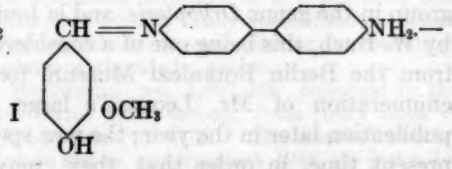
Cumidines

5-Iodo-vanillidene pseudo-cumidine C_6H_2 $(\overset{3}{O}CH_3)$ $(\overset{4}{O}H)$ $(\overset{5}{I})$ $CH = \overset{5}{N}C_6H_2$ $(\overset{1}{C}H_3)$ $(\overset{2}{C}H_3)$ $\overset{4}{C}H_3$.—This anil was obtained as a chocolate brown powder. Upon vigorous trituration it becomes yellow, the color change being well marked. The substance is soluble in the usual organic solvents and melts at 165°C. when slowly heated.

Analysis: 0.2457 gram of substance consumed 6.0 cc. $\frac{N}{10}$ acid (Kjeldahl) 3.42 per cent N. Theory for $C_{17}H_{18}O_2N$ I = 3.54 per cent N.

Di-amines

5-Iodo-vanillidene-benzidene



Equimolecular proportions of the aldehyde and amine were heated together for two hours in alcoholic solution, filtered, and rapidly cooled. The condensation product separated in bright orange flocks. Upon trituration it undergoes the most marked color change of any of these derivatives, assuming a bright crimson color, somewhat like,

though not exactly comparable with, that of mercuric iodide. The substance is slightly soluble in ether and benzene, soluble in ethyl and methyl alcohols, and very soluble in acetone and chloroform. It undergoes incipient decomposition when heated, melting to a deep red oil at 160–1°C.

Analysis: 0.2100 gram of substance consumed 9.4 cc. $\frac{N}{10}$ acid (Kjeldahl) 6.27 per cent N. Theory for $C_{20}H_{17}O_2N_2I$ = 6.30 per cent N.

Summary

A number of derivatives of the Schiff base type have been prepared from 3-methoxy-4-hydroxy-5-iodo-benzaldehyde and aromatic amines.

The 5-iodo vanillidene aryl amines are not phototropic.

The addition of iodine to meta methoxy para hydroxy benzaldehyde apparently reduces its ability to yield thermotropic anils when condensed with amines.

Upon vigorous trituration the condensation products of the aldehyde and amines produce polymorphic forms, differing markedly in color

BOTANY.—*New or critical ferns from Haiti.*[1] WILLIAM R. MAXON, National Museum.

The present paper contains descriptions of four new species of Polypodiaceae from Haiti, as well as notes upon several other species that either are new to the Haitian flora or have other points of interest. Of the new species three are based upon material collected in the early part of 1920 by E. C. Leonard of the U. S. National Museum, while accompanying Dr. W. L. Abbott on an extended trip of biological exploration in Haiti. The other new species belongs to a critical group in the genus *Dryopteris*, and is founded on a specimen collected by W. Buch, this being one of a considerable number recently received from the Berlin Botanical Museum for identification. A complete enumeration of Mr. Leonard's large collection will be offered for publication later in the year; the new species only are published at the present time, in order that they may be available for citation by Dr. I. Urban, who is about to publish a systematic catalog of the pteriodophyta known from the island of Hispaniola.

[1] Published by permission of the Secretary of the Smithsonian Institution.

Adiantum cuneatum Langsd. & Fisch.

A single collection: Morne de Ouésanne, Furcy, altitude 1,300 meters, in shaded ravine, June 13, 1920, *Leonard* 4781.

Apparently indigenous. So far as the writer knows, this South American species has not previously been reported as native to the West Indies. It is cultivated the world over and in tropical regions is known to have sometimes escaped and become naturalized; for example, on banks in the vicinity of the botanical station at Cinchona, Jamaica, at 1,500 meters elevation.

Cheilanthes leonardi Maxon, sp. nov.

Rhizome multicipital, the divisions 1 to 3 cm. long, horizontal, densely paleaceous, the scales oblique, imbricate, rigid, subulate to linear-triangular and attenuate, 2 to 3 mm. long, up to 0.5 mm. broad at base, dark castaneous, greatly thickened throughout, entire. Fronds numerous, close, rigidly erect, mostly 20 to 30 cm. high; stipes 14 to 21 cm. long, 0.3 to 0.6 mm. thick, straight above the arcuate base, wiry, dull dark castaneous, naked; blades broadly ovate-deltoid, subpentagonal, 6 to 11 cm. long, 3.5 to 10 cm. broad at base, sub-bipinnate below, deeply pinnatifid at apex, both the apex and pinnae conspicuously long-caudate; rachis similar to stipe, but closely glandular-puberulous along the ventral groove; main pinnae 1 to 3 pairs, ascending, the basal ones the largest, these sessile, deltoid in outline, inequilateral, 2 to 6 cm. long, 1.5 to 4.5 cm. broad at base, nearly pinnate, with 1 to 5 pairs of segments (the proximal basal one longest), these distant, subopposite, oblique, narrowly linear, 2 mm. broad, arcuate, abruptly discontinuous, the apical segment greatly elongate, linear, up to 4 cm. long in large specimens; second pair of pinnae 1 to 2 cm. distant, adnate, elongate-triangular, strongly inequilateral, in small blades simple or with a single elongate proximal basal segment, in larger blades with 3 to 5 proximal and 1 to 3 distal segments, these all distant, linear, simple; third pair of pinnae simple or sometimes with 1 or 2 proximal basal segments; remaining pinnae simple, narrowly linear, oblique, decurrent, the apical ones joined by a rachis wing as broad as their own width, abruptly discontinuous, the long-caudate terminal segment up to 5.5 cm. long in large blades, 2 mm. broad at base; veins free, arcuate, once-forked, impressed above; segments subcoriaceous, evenly and obliquely crenate from the development of saccate recesses underneath the sharply revolute margin, a vein-branch terminating at each sinus; sori terminal (the receptacle transversely enlarged), the sporangia spreading laterally in a continuous line, partly concealed; indusium continuous, brown, firmly membranous, broad, often extending nearly to the strongly elevated costa, flat or (at maturity) arched or even reflexed to the plane of the blade, entire.

Type in the U. S. National Herbarium, no. 1,077,048, collected in the vicinity of Furcy, Haiti, altitude about 1,300 meters, from rocky bank of a ravine, June 5, 1920, by E. C. Leonard (no. 4552). Represented also by *Leonard* 4483 and 4498 from the same region, and by *Buch* 1946, the last a depauperate specimen from Morne de Brouet,[2] Haiti, in the Berlin Museum.

Cheilanthes leonardi belongs to the subgenus *Mildella*, and is the West Indian analogue of *C. intramarginalis* (Kaulf.) Hook., which ranges from Mexico to Bolivia. From that species it differs sufficiently in its slender

[2] According to Mr. Leonard this is the same mountain called by the natives "Morne de Ouésanne."

stipes, its short, ovate-deltoid (not lanceolate or oblong), long-caudate blades, its few and much simpler, conspicuously caudate pinnae, and its few, narrowly linear, invariably simple, distant pinnules.

Hypolepis hispaniolica Maxon, sp. nov.

Plants about 2 meters high, semierect; rhizome not collected; blades about 1.5 meters long, at least 1.2 meters broad, subquadripinnate; primary rachis 3 mm. thick, cinnamomeous, sparingly aculeate (the spines 0.5 to 1 mm. long, conical, pungent, spreading or retrorsely curved), with a loose deciduous covering of bright brown, flexuous, flattish, intestiniform hairs; primary pinnae oblique, sessile, triangular-oblong, acuminate, the largest ones 65 cm. long or more, about 35 cm. broad just above the base, the secondary rachis aculeate like the primary; secondary pinnae about 10 pairs below the acuminate apex, distant, spreading, antrorsely falcate, the distal basal one greatly reduced, the other distal ones somewhat shorter than the proximal ones, all narrowly triangular-oblong, acuminate, the largest 20 cm. long, 10 cm. broad, the tertiary rachis subflexuous, aculeolate; pinnules about 12 pairs, spreading, distant, alternate, the distal basal one greatly reduced or vestigial, the others fully developed, pinnate, oblong or deltoid-oblong from an inequilateral base, long-acuminate, the costa everywhere minutely aculeolate beneath, narrowly foliaceo-marginate; segments 7 or 8 pairs below the tip, spreading, oblong or obliquely ovate-oblong, excavate at proximal base, the larger ones nearly free, all deeply crenate or crenately lobed, the lobes minutely bicrenate; segments rigidly herbaceous, brownish or dull grayish green in drying, opaque, glabrous above, beneath persistently yellowish-strigose along the oblique prominulous veinlets, the hairs septate; sori 3 or 4 in fertile segments, seated between the lobes, marginal, 1 mm. broad; indusia about 0.3 mm. broad, herbaceous, yellowish, translucent, concave, not covering the sporangia.

Type in the U. S. National Herbarium, nos. 1,077,327–9, collected on open slopes of Morne de Ouésanne, vicinity of Furcy, Haiti, altitude 1,300 meters, June 13, 1920, by E. C. Leonard (no. 4796).

Among known members of the genus *H. hispaniolica* need be compared only with *H. nigrescens* Hook., which differs in its lax, dark green blades of thin texture, its much more strongly aculeate rachises (the spines dark), its broader and much closer secondary pinnae and pinnules, and its closer and more numerous segments (these nearly glabrous beneath), the lobes deeply dentate-crenate.

Hypolepis hispaniolica attains a much greater size than indicated in the description. This is shown by a section from a large primary pinna collected in Barahona Province, Dominican Republic, by Fuertes (no. 1335b), which is nearly 60 cm. broad and evidently came from a nearly 5-pinnate blade. There is a similar range of dissection in *H. nigrescens*, according to age of plant and position of pinnae. Mature fronds of *H. nigrescens* are often as much as 2.5 meters broad. Those of *H. hispaniolica* doubtless attain similar dimensions.

Pteridium arachnoideum (Kaulf.) Maxon.

Pteris arachnoidea Kaulf. Enum. Fil. 190. 1824.

Vincinity of Mission, Fonds Varettes, altitude 1,000 meters and above, forming thickets 2.5 to 3 meters high, on mountain slopes, *Leonard* 2883. Near Furcy, altitude 1,300 meters, common, forming thickets 2 meters high or more, *Leonard* 4339, 4591.

This is common throughout the mountains of tropical America, rarely descending below 1,000 meters, and is commonly listed as a variety (var. *esculentum*) of *P. aquilinum*. It is, however, amply distinct from the Australasian plant described by Forster in 1786 as *Pteris esculenta*, and is readily distinguished from related American forms, among other characters, by the transverse arclike costal auricles that connect the segments and apical pinnules.

Asplenium heterochroum Kunze.

A single collection: Mission, Fonds Varettes, altitude 1,000 meters and above, on dryish cliff, *Leonard* 5333.

Apparently new to Hispaniola. Previously known from Bermuda, Cuba, Porto Rico, and peninsular Florida.[3]

Asplenium resiliens Kunze.

Vicinity of Mission, Fonds Varettes, altitude 1,000 meters and above, occasional, on steep rocky slopes, *Leonard* 3984. Base of Mt. Tranchant, near Furcy, altitude 1,300 meters, on rocks, *Leonard* 4368a.

The specimens are indistinguishable from continental material ranging from the southern United States to Guatemala. Known also from the Blue Mountains of Jamaica, at 1,500 to 1,800 meters elevation.[4]

Struthiopteris tuerckheimii (Brause) Maxon.

Blechnum tuerckheimii Brause in Urban, Symb. Ant. **7**: 159. 1911.

Mission, Fonds Varettes, *Leonard* 3915. Near Furcy, occasional or locally common in bracken thickets and on rocky slopes, *Leonard* 4319, 4461, 4496.

The specimens cited agree closely with an example of the type collection from Constanza, Dominican Republic (*Türckheim* 2976), though some of them are larger. The species belongs under *Lomaria*, which Brause merges with *Blechnum*, following Diels and Christensen. Miss Broadhurst in treating the species of this alliance has regarded *Lomaria* as a distinct genus, and has shown[5] the necessity of adopting for it the name *Struthiopteris* (Hall.) Scop., 1760.

Dryopteris abbottiana Maxon, sp. nov.

Subgenus *Lastrea*. Rhizome wanting, presumably ascending; fronds 80 to 90 cm. long, laxly ascending; stipe (from base to lowest vestigial pinnae) about 20 cm. long, fuliginous to dull stramineous, sulcate, densely grayish-puberulous, and bearing a very few, distant, pale brownish, linear scales

[3] Contr. U. S. Nat. Herb. **17**: 140, 141. *f. 2*. 1913; **24**: 62. 1922.

[4] Contr. U. S. Nat. Herb. **17**: 143, 144. 1913.

[5] Bull. Torrey Club **39**: 257–259. 1912.

(2 to 4 mm. long); blades lanceolate, 65 to 70 cm. long, 16 to 24 cm. broad in the lower third, long-acuminate at apex, very abruptly reduced at base, with about 3 pairs of glanduliform vestigial pinnae, these mostly 1.5 mm. long, alternate, distant, the lowest one 20 cm. below the blade proper; rachis greenish-stramineous, densely whitish-puberulous, the hairs persistent; pinnae 20 to 25 pairs below the tip, alternate, slightly oblique, nearly straight, linear, up to 13 cm. long and 2 cm. broad, attenuate (the tip subcaudate, serrate to subentire), sessile, pinnatifid to about 1 mm. from the costa, the costa elevated beneath, densely antrorse-hirtellous on both surfaces; main segments of larger pinnae about 25 pairs, narrowly oblong, up to 12 mm. long, 3 to 4 mm. broad, slightly oblique, subfalcate, acutish distally, with acutish open sinuses, the basal ones of the lower 2 or 3 pairs (above the vestigial pinnae) greatly reduced; margins narrowly revolute, antrorsely ciliate; midveins elevated and antrorsely hirtellous beneath; veins 10 to 12 pairs, oblique, mostly straight (the basal ones curved), elevated on both surfaces, glabrous beneath, conspicuously scabrous above; leaf tissue membranous, above dull green and minutely scabrous, beneath paler, sublustrous, eglandulose, obscurely pilosulous, the hairs erect, delicate, persistent; sori small, 9 to 12 pairs, medial, round, 10 to 15-sporangiate, the sporangia glabrous; indusia very minute, reduced to a few short connate hairs, concealed by the sporangia.

Type in the U. S. National Herbarium, no. 1,077,220, collected on Morne de Ouésanne, near Furcy, Haiti, altitude 1,300 meters, in bed of a wet ravine, June 11, 1920, by E. C. Leonard (no. 4709). Two additional fronds of the type number are preserved. Represented also by *Leonard* 4739a, from the same locality.

Dryopteris abbottiana is related to *D. demerarana* (Baker) C. Chr., of British Guiana, and *D. rusbyi* C. Chr., of Bolivia, both of which are of similar proportions, with the blade very abruptly reduced to vestigial pinnae at the base, and have the leaf tissue appressed-pubescent above. *D. demerarana* is distinguished by its broader, less attenuate, less deeply pinnatifid, and mostly subopposite pinnae, its fewer, closer, broader, and less acute segments, its fewer veins (7 to 9 pairs, the proximal basal one often forked), and its distinctly supramedial sori. The sori have been described as exindusiate, but the remnant of an indusium, consisting of a few persistent connate hairs, is invariably evident in a specimen of the type collection (*im Thurn* 356). *Dryopteris rusbyi* is perhaps more nearly related, but is at once distinguished by its horizontal *opposite* pinnae and its close-set patent segments. All three species form a natural subgroup which must be studied in connection with *D. rustica*, as that species is interpreted by Christensen.

Dryopteris rudis (Kunze) C. Chr.

Mission, Fonds Varettes, altitude 1,000 meters, in thickets on mountain slopes, *Leonard* 3868; occasional in open pine woods, *Leonard* 3918. Morne de Ouésanne, near Furcy, altitude 1,300 meters, common in damp thickets, *Leonard* 4662; occasional, on steep mossy banks, *Leonard* 4626.

Collected in the same region also by W. Buch (nos. 1698 and 1706). Not reported from Hispaniola by Christensen.

Dryopteris haitiensis (Brause) Urban & Maxon, sp. nov.

Dryopteris subincisa haitiensis Brause, Ark. för Bot. **17**: 67. 1922.

Rhizome wanting; frond (incomplete) 1 meter long, rigidly erect; stipe (incomplete) 33 cm. long, 5 mm. thick, nearly terete, light brown, opaque, persistently paleaceous, the scales divaricate, linear-attenuate, 10 to 13 mm. long, about 1 mm. broad at base, brown, rigid, retrorsely denticulate toward the tip; blades lanceolate, acuminate, 67 cm. long, 18 cm. broad at base, 28 cm. broad at middle, bipinnate-pinnatifid, the primary rachis divaricate-paleaceous like the stipe, the scales smaller; pinnae about 13 pairs, spreading, the lowermost 10 cm. long, 5.5 cm. broad at base, narrowly triangular, inequilateral, basiscopic, borne 10 cm. below the second pair; middle pinnae subopposite, 5 to 6 cm. apart, strongly catodromous, sessile, triangular-oblong, long-acuminate, nearly equilateral, 14 to 16 cm. long, about 5.5 cm. broad at base, pinnate-pinnatifid, the rachis densely hirsutulous with short several-celled brownish hairs on both surfaces, beneath scantily divaricate-paleaceous, the scales brown, lance-attenuate, 3.5 to 5 mm. long, minutely denticulate throughout; pinnules of middle pinnae about 13 pairs, distant, subarcuate, the basal ones the largest, subsessile, elongate-triangular, deeply pinnatifid (lobes about 5 pairs), those beyond less deeply pinnatifid, semiadnate, those of the outer half merely crenate, broadly adnate or dilatate at base, the apical ones passing gradually into the coarsely crenate tip of the pinna; costae of pinnules slightly strigose-hirsutulous above at base, beneath sparingly yellowish-hirsutulous throughout; lobes rounded-oblong to semicircular, the margins narrowly revolute, rather freely ciliate; leaf tissue brownish green, thick-herbaceous, glabrous on both surfaces; sori large, numerous, nonindusiate, mostly borne in distant groups of 2 or 3, only the largest lobes having 3 or 4 pairs each.

Type in the herbarium of the Berlin Botanical Museum, collected at Ma Blanche, Morne de la Hotte, Département du Sud, Haiti, altitude about 1,400 meters, October 7, 1917, by E. L. Ekman (no. 556). A single pinna is preserved in the U. S. National Herbarium (no. 1,145,498).

The present species, which was indicated by Dr. Urban as possibly new, shows no very close alliance with *D. subincisa* (Willd.) Urban, with which it was associated in a varietal sense by Brause. It is immediately distinguished by its small size and lanceolate blades, the basal pinnae being distant and somewhat reduced, whereas in all forms of *D. subincisa* the blade is deltoid, the basal pinnae being the largest and best developed of all. It belongs to the group of *D. subincisa*, but among the species thus far described it appears to have no very near relatives.

Dryopteris asterothrix (Fée) C. Chr.

A single specimen: Mission, Fonds Varettes, altitude about 1,000 meters, on dry cliffs, *Leonard* 5337.

A rare but widely distributed species known from a few plants collected

in Cuba, Jamaica, Guatemala, Costa Rica, and Venezuela, and more recently the Dominican Republic (*Eggers* 2503, 2528). New to Haiti.

Dryopteris alata (L.) Maxon.

Polypodium alatum L. Sp. Pl. 1086. 1753.

Vicinity of Mission, Fonds Varettes, altitude about 1,000 meters, occasional at edge of trail through thickets, April 23, 1920, *Leonard* 3797.

This species, founded by Linnaeus on Petiver's *Polypodium serratum majus costa alata* (pl. 7, fig. 13), has been practically unknown, at least in so far as actual specimens are concerned, for well over 200 years. The name *Polypodium alatum* L. is referred to *Dryopteris scolopendroides* (L.) Kuntze in Christensen's Index Filicum, but is mentioned in none of his papers on *Dryopteris*, published subsequently. That the reference is incorrect is clearly shown by the above-cited specimens. These agree well with Plumier's plate 84 (the prototype of the Petiver illustration), representing a plant from the Leoganne region, Haiti, and certainly are specifically distinct.

From *D. scolopendroides* in all its forms *D. alata* differs conspicuously in size and in its much greater subdivision. The blades are 40 to 50 cm. long and 7 to 10 cm. broad, and are pinnatifid almost to the rachis, being in fact subpinnate nearly throughout, the segments *distant*, lanceolate, 4 to 6 cm. long, long-acuminate, and themselves lobed half-way to the costa, each lobe with a strongly elevated costule and 5 to 9 pairs of oblique, pinnately arranged veins. The blades are thus once more divided than those of *D. scolopendroides;* as to venation the primary segments correspond to whole blades of the latter species. In addition, most of the blades end abruptly in huge viviparous buds, as opposed to the long-attenuate non-proliferous tips of *D. scolopendroides*. These characteristic differences are shown by illustrations which will accompany the report on Mr. Leonard's collection.

Polystichum machaerophyllum Slosson.

Morne de Ouésanne, near Furcy, altitude 1,300 meters, common on a wooded slope, *Leonard* 4779.

Known previously only from eastern Cuba (*Shafer* 3262, 4127, 8096; *Wright* 828 in part; *Pollard, Palmer & Palmer* 237). It is a very close ally of *P. ilicifolium* Fée, of the same region.

Polystichum polystichiforme (Fée) Maxon.

Rivière Boucandie, Furcy, occasional in damp shady ravine, *Leonard* 4443. Morne de Ouésanne, Furcy, altitude 1,300 meters, on wet rocks, *Leonard* 4718.

Known hitherto from Cuba, Jamaica, and Porto Rico. Some of the Haitian specimens are larger than other Antillean material at hand, and approach the continental *P. platyphyllum* (Willd.) Presl, as that collective species is still regarded.

BOTANY.—*New species of plants from Salvador. III.*[1] PAUL C. STANDLEY, National Museum.

Zamia herrerae Calderón & Standl., sp. nov. (Fig. 1).

Leaves few, the petioles slender, scarcely half the length of the rachis, glabrous, furnished with a few remote stout spines 1–2 mm. long, similar spines present also on the rachis; leaf rachis very slender, about 35 mm. long; leaflets about 50, nearly linear, 15–22 cm. long, 8–13 mm. wide, 17 to 21-nerved, thick, very lustrous, paler beneath, the margins bearing a few distant (about 2 cm. apart) appressed spine-tipped teeth, the lower third of the blade entire, the blades gradually attenuate from the lower third to the tip; inflorescence and fruit unknown.

Type in the U. S. National Herbarium, no. 1,165,680, collected in the vicinity of Sonsonate, Salvador, July 17, 1923, by Dr. Salvador Calderón (no. 1682).

Although known only from sterile material, there is little doubt that the present plant represents an undescribed species of this interesting genus, of which several other Central American representatives are known. This is probably the first *Zamia* to be reported from the Pacific coast of Central America.

The species is named in honor of Sr. Dr. Héctor Herrera of Sonsonate, an enthusiastic scientist and promoter of scientific work, whose delightful hospitality we have experienced upon the occasion of several visits to that city.

Aeschynomene calderoniana Standl., sp. nov.

Slender shrub, 1–2 m. high, with few branches, the young branchlets densely puberulent; stipules caducous; petioles short (mostly 6–10 mm.), the leaf rachis 2–5.5 cm. long, finely appressed-pubescent or glabrate; leaflets 5–10 pairs, oval-oblong or oblong-obovate, 9–18 mm. long, 5–8 mm. wide, broadly rounded at apex and obscurely mucronate, obliquely rounded at base, nearly sessile, rather thick, when young sparsely setose-strigose but soon glabrate, the venation beneath laxly reticulate and somewhat prominent, the costa central or nearly so; flowers in few-flowered axillary racemes shorter than the leaves, dark purple, the rachis densely puberulent, the pedicels about 4 mm. long; calyx 2–2.5 mm. long, covered with short appressed whitish hairs; standard petal 6–7 mm. long, suborbicular, densely whitish-sericeous outside, the other petals nearly as long, glabrous; joints of the fruit 1 or 2, semiorbicular or nearly so, 10–15 mm. long, 6–8 mm. wide, thin, nearly smooth, densely whitish-strigillose or finally glabrate.

Type in the U. S. National Herbarium, no. 1,136,211, collected on dry open hillside above Santa Ana, Salvador, January, 1922, by Paul C. Standley (no. 20367).

[1] Published by permission of the Secretary of the Smithsonian Institution. The last preceding paper of this series was published in this Journal, Vol. 13, pp. 436–443.

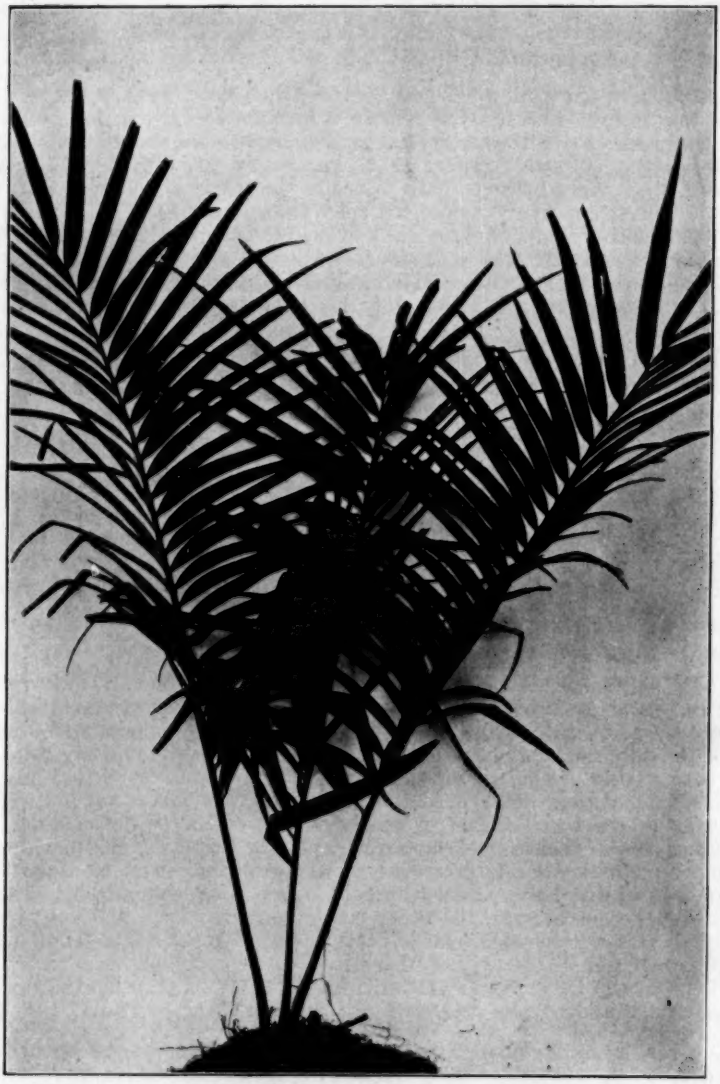


Fig. 1. *Zamia herrerae* Calderón & Standl.
(About one-fourth natural size)

A well-marked species, not closely related to any of those previously reported from Central America or Mexico. It is named in honor of Sr. Don Oscar Núñez Calderón, who was a helpful and highly esteemed companion during nearly a month spent in the western departments of Salvador.

Machaerium marginatum Standl., sp. nov.

Shrub 3–4 m. high, the trunk armed with large stout spines; young branchlets thick and succulent, sparsely pilose; stipules 8–12 mm. long, oblong-lanceolate, compressed, thick and indurate, spinose, densely pilose-sericeous on both surfaces; leaves long-petiolate, the petioles slender, sparsely pilose or glabrate; leaflets subopposite, about 13, the petiolules stout, 4–5 mm. long, sparsely short-pilose or glabrate, the blades oblong or oblong-elliptic, 8–13 cm. long, 3–5.5 cm. wide, abruptly acuminate, rounded at base, thick, very lustrous, when young sparsely pilose and puberulent beneath along the costa, elsewhere glabrous, the venation conspicuous but little elevated, the margin cartilaginous-thickened; inflorescence terminal, forming a very large panicle, much branched, the branches copiously short-pilose or somewhat tomentose, becoming glabrate, bearing also numerous scalelike trichomes, these lance-subulate, broadened at base, pilose, terminating in a slender yellow bristle, the scales upon the ultimate branchlets setiform; bracts similar to the stipules, indurate; flowers in short racemes, the pedicels about 2 mm. long; bractlets lanceolate or ovate, nerved, bearing numerous subulate-setiform yellowish hairs; calyx 5 mm. long, obtuse at base, sparsely yellow-setose, obliquely 5-dentate, the teeth broadly triangular, obtuse, finely appressed-pubescent; petals dirty pinkish white, the standard 8–9 mm. long, abruptly recurved, densely whitish-sericeous outside, the other petals glabrous, the keel petals slender-clawed, united above; ovary linear, strongly curved, densely appressed-pilose, the style slender, glabrous.

Type in the U. S. National Herbarium, no. 1,137,184, collected on a dry brushy slope near San Vicente, Salvador, altitude about 400 meters, March, 1922, by Paul C. Standley (no. 21381).

The type specimen consists of flowering material, without leaves, the shrub being leafless at flowering time. The description of the leaves is drawn from *Standley* 20146, collected on the Finca Colima, Sierra de Apaneca, Departamento de Ahuachapán, in January of the same year. The second collection consists only of leaves, but there is little doubt that it represents the same species. The vernacular name given at the Finca Colima was *sangre bravo*.

Machaerium marginatum is perhaps related to *M. pachyphyllum* Pittier, a Panaman species, but it is not likely to be confused with any plant of the genus previously reported from Central America. Sterile specimens collected by the writer at Quiriguá, Guatemala, in March, 1922, (no. 23935) represent either the same or a very closely related species, and I have also seen specimens from Oaxaca, Mexico, which are perhaps conspecific.

Banisteria rosea Standl., sp. nov.

Large woody vine, the branches slender, brownish, the young branchlets densely and loosely sericeous but soon glabrate; petioles 3–6 mm. long, glabrate; leaf blades elliptic or elliptic-ovate, 2.5–6 cm. long, 1.5–3.5 cm. wide, acute to very obtuse at apex, rounded or obtuse at base, thin, when young densely and loosely appressed-pilose but soon glabrous, pale beneath, bearing near the base of the blade 2–4 sessile glands; inflorescence of lax few-flowered axillary panicles 4–6 cm. long, their branches slender, loosely tomentose or finally glabrate, the bracts leaflike, 5–7 mm. long; pedicels slender, mostly 4–6 mm. long, bearing 2 small bractlets about the middle; sepals 2.5–3 mm. long, oval, rounded at apex, sericeous, the glands scarcely half as long as the sepal body; petals 4–5 mm. long, pink; samaras 1 or 2, about 2.5 cm. long, densely or sparsely strigose, the wing thin, dilated toward the apex and 7–8 mm. wide, thickened along the dorsal margin, the body coarsely reticulate-veined, not crowned.

Type in the U. S. National Herbarium, no. 1,137,424, collected in a ravine at the base of the Volcán de San Vicente, near the town of San Vicente, Salvador, March, 1922, by Paul C. Standley (no. 21663). Also collected in flower at La Unión in February, 1922, *Standley* 20653.

Related to *B. retusa* (Donn. Smith) C. B. Robinson and *B. purpurea* L. *Banisteria rosea* is a handsome vine of the lowlands of Salvador, its abundant flowers at a distance resembling apple blossoms. At La Unión the vernacular name of *florecita de pensamiento* was given for it.

Acalypha salvadorensis Standl., sp. nov.

Plants apparently annual, more than 30 cm. high, erect, the stems densely cinereous-puberulent, with elongate internodes; stipules minute; petioles very slender, 1.5–3.5 cm. long, puberulent and with a few short gland-tipped hairs (these present also upon the stems); leaf blades ovate or broadly ovate, 3–4.5 cm. long, 1.5–3 cm. wide, acute or the lowest obtuse, rounded or obscurely emarginate at base, evenly and rather finely crenate, thin, on the upper surface sparsely setulose-hirsute and scaberulous, beneath finely pubescent; plants monoecious, the staminate spikes axillary, subglobose, usually less than 2 mm. long, borne on slender peduncles 2–4 mm. long; pistillate spikes terminating the main branches and much reduced ones (about 1 cm. long) borne on short leafy axillary branches; terminal spikes very dense, 2.5–5 cm. long, about 1 cm. thick, the rachis densely cinereous-puberulent; bracts reniform, 5–7 mm. long, sparsely white-hirsute and densely short-pilose, also with numerous short gland-tipped hairs, the margin with about 8 very short obtuse teeth; styles divided into numerous slender filiform branches; capsule 2 mm. in diameter, broader than high, obtusely lobate, finely pubescent; seeds subglobose, grayish, closely foveolate.

Type in the U. S. National Herbarium, no. 1,165,685, collected in San Salvador, Salvador, July, 1923, by Dr. Salvador Calderón (no. 1741).

The plant is of a decidedly weedy and ordinary appearance, but it is not matched by an herbarium material available, nor does it agree with any description with which it has been compared.

Croton payaquensis Standl., sp. nov.

Shrub, 1 m. high or less, or often nearly wholly herbaceous, sparsely branched, the branches densely covered with a pubescence of white or yellowish, appressed, sessile trichomes consisting of numerous radiating branches; stipules subulate, entire, caducous; petioles stout, 5–12 mm. long, densely stellate-tomentose; leaf blades oblong-ovate to ovate-oval, 2.5–7 cm. long, 1.5–4 cm. wide, rounded at apex, broadly rounded or subcordate at base, thick, obscurely glandular-denticulate, densely stellate-tomentose on both surfaces or in age glabrate and green above, whitish beneath, eglandular; flower spikes axillary, sessile, sometimes 6 cm. long and many-flowered but often very short and few-flowered, the flowers short-pedicellate; staminate flowers subglobose in bud and 1–1.5 mm. in diameter, petaliferous; stamens about 8, the receptacle densely white-pilose; pistillate calyx sparsely stellate-pubescent or glabrate, the five lobes lance-oblong, subequal, acute; young fruit densely stellate-tomentose, becoming glabrate; styles bipartite, the branches densely stellate-pubescent below, glabrous above.

Type in the U. S. National Herbarium, no. 1,151,991, collected on the Cerro de la Olla, on the Guatemalan frontier near Chalchuapa, Salvador, in 1922 by Dr. Salvador Calderón (no. 1024). The following additional specimens have been examined:

SALVADOR: Santa Ana, *Standley* 20351. Laguna de Maquigüe, *Standley* 20941.

Similar in general appearance to *C. cortesianus* H.B.K., which, however, is conspicuously distinct in its acute leaves which are glabrous on the upper surface. At Maquigüe the vernacular name was given as *friega-plato*. The specific name is derived from Payaquí, a name given in preconquest times to the region about the Lake of Güija.

Ophellantha Standl., gen. nov.

Small trees, the indument scant, of simple hairs; leaves alternate, petiolate, membranaceous, penninerved, remotely denticulate; stipules 2, small, spinose, persistent; flowers monoecious, long-pedicellate, solitary or fasciculate on axillary spurs; staminate calyx 5-parted, the lobes in anthesis slightly imbricate; petals 5, distinct, entire, much longer than the calyx, sessile, ciliate; disk large, densely short-hirsute; stamens numerous (50 or more), irregularly inserted over the disk, the filaments elongate, filiform, glabrous; anthers small, 2-celled, dehiscent by 2 introrse slits, each cell bearing at the apex a short filiform appendage; rudimentary ovary absent; sepals of the pistillate flower 5, becoming large and leaf-like after anthesis; petals not seen; margin of the disk very shallowly 5-lobate; ovary 2-celled, sessile; styles 2, stout, nearly or quite distinct, bifid for one-third their length; ovules solitary; capsule 2-celled, the cells loculicidally and septicidally bivalvate, separating from the persistent flattened column; seeds large, ecarunculate, smooth or nearly so; cotyledons broad and plane, the endosperm fleshy.

Type species, *Ophellantha spinosa* Standl.

Ophellantha is apparently to be referred to the *Acalypheae-Chrozophorinae* of the family Euphorbiaceae, and in the key to the genera of that group

given by Pax in Engler's Pflanzenreich[2] it would run at once to *Speranskia*, a genus of herbaceous plants occurring in China. *Ophellantha* is clearly distinct in various important characters from each genus of the group treated by Pax. All the other genera of the group have a 3-celled capsule, but it may be that a 2-celled fruit is not constant in the Salvadorean plant.

Ophellantha spinosa Standl., sp. nov.

Tree, 4.5–6 m. high, the branchlets slender, brownish, with few large elevated lenticels, the young branchlets rather sparsely furnished with short acicular appressed hairs; stipular spines 3–5 mm. long, much enlarged at base; leaves on young branchlets alternate, no branches of the preceding years fasciculate at the nodes, the petioles slender, 10–14 mm. long, pubescent like the branchlets; leaf blades elliptic or ovate-elliptic, 5–9 cm. long, 2.5–5.5 cm. wide, acute or short-acuminate, with blunt tip, acute at base and decurrent upon the petiole, thin, green above, paler beneath, furnished along the nerves with appressed acicular hairs, glabrate elsewhere, densely appressed-ciliate, obscurely and remotely glandular-denticulate, the margin often slightly repand; pedicels slender, 1.2–1.8 cm. long; staminate sepals broadly ovate, 1–1.5 mm. long, appressed-pilosulous; petals oval, green, about 5 mm. long, rounded at apex, glabrous, ciliolate; disk 4 mm. in diameter, the filaments 4–5 mm. long; pistillate sepals oblong-elliptic, in fruit about 1.5 cm. long, obtuse or acutish, denticulate, 5-nerved, foliaceous, green, glabrate, sparsely ciliolate; styles 5–6 mm. long, appressed-setulose; capsule 1.5 cm. long, appressed-setulose or glabrate, smooth, the walls very thick; seeds about 10 mm. long and 6–7 mm. broad, glabrous, the surface irregularly mottled with brown and grayish.

Type in the U. S. National Herbarium, no. 1,137,579, collected in a thicket on the mountain slopes above Izalco, Departamento de Sonsonate, Salvador, March, 1922, by Paul C. Standley (no. 21819).

The vernacular name of the tree was given as *limoncillo*.

Triumfetta calderoni Standl., sp. nov.

Shrub or tree, often 6–8 m. high, with smooth pale bark and spreading open crown; stems densely covered with a double indument of fine stellate hairs and of coarse stiff spreading ones; petioles 3–7 cm. long, densely tomentose; leaf blades mostly ovate or rounded-ovate, 9–15 cm. long, 5–11 cm. wide, rather abruptly acuminate or long-acuminate, rounded or subcordate at base, coarsely and irregularly crenate-dentate, sometimes obscurely 3-lobate or angulate, stellate-setulose or stellate-tomentulose on the upper surface or finally glabrate, beneath pale and usually densely stellate-tomentose; panicles terminal and axillary, often very large in fruit, the branches densely stellate-tomentose; pedicels 2–3 mm. long or in fruit longer; sepals oblong-linear, 4–5 mm. long, not appendaged at apex, minutely tomentose outside; petals oblong, glabrous, about one-third as long as the sepals; fruit 5–7 mm. long (including the bristles), covered with numerous very slender bristles, these densely pilose with stiff spreading whitish hairs.

[2] IV, 147: 10. 1912.

Type in the U. S. National Herbarium, no. 1,151,087, collected in the vicinity of San Salvador, Salvador, December, 1921, by Dr. Salvador Calderón (no. 78). The following additional collections also represent the same species: SALVADOR: San Salvador, *Calderón* 354, 1257; *Standley* 19114. San Marcos, Departamento de San Salvador, *Standley* 22782. Tonacatepeque, Departamento de San Salvador, *Standley* 19475.

A well-marked species, characterized by its densely pilose fruit and minute petals.

Abutilon calderoni Standl., sp. nov.

A much-branched shrub, 1–3 m. high, the branchlets terete, covered with a minute close grayish tomentum; petioles slender, 5–11 cm. long; leaf blades broadly ovate-cordate to orbicular-cordate, 8–17 cm. long, 5.5–14 cm. wide, rather abruptly acuminate or long-acuminate, deeply cordate at base, shallowly and finely crenate, often rather remotely so, sometimes obscurely 3-lobate near the apex, thin, green above, thinly and extremely minutely stellate-pubescent, beneath covered with a fine close grayish stellate tomentum; flowers orange, mostly in large open pyramidal terminal panicles; pedicels slender, 1.5–3.5 cm. long, jointed near the base; calyx lobes ovate, 5–6 mm. long, acute, densely pubescent, appressed or spreading in fruit; petals 12–15 mm. long, glabrate outside, spreading; stamen tube about 7 mm. long, stellate-pubescent, much enlarged below; carpels 10 or 11, 8 mm. long, 2 or 3-seeded, obtuse or rounded at apex, stellate-tomentose.

Type in the U. S. National Herbarium, no. 1,152,613, collected in waste ground in San Salvador, Salvador, in 1923 by Dr. Salvador Calderón (no. 1639). The following additional specimens have been examined:

SALVADOR: San Salvador, *Standley* 22676. Volcán de San Salvador, *Standley* 22984.

A specimen collected by Dr. Calderón at Zacatecoluca in March, 1922, (no. 330) differs from the typical form only in having the branches, especially those of the inflorescence, pilose with long spreading stiff hairs. It is probably only a variant form, and may be known as **Abutilon calderoni** var. **longipilum** Standl. (type, U. S. Nat. Herb. no. 1,151,348). The vernacular name of the Zacatecoluca plant is *malva*.

Abutilon calderoni is a relative of *A. giganteum* (Jacq.) Presl, which is distinguished by its substantially larger carpels.

SCIENTIFIC NOTES AND NEWS

The Petrologists' Club and the Geological Society of Washington were hosts to a number of visiting geologists on the occasion of a field trip made December 30 to the diabase quarry at Goose Creek, near Belmont Park, Virginia, and the limestone quarries at Leesburg. Features of especial interest were the diabase-pegmatitic segregations at the Goose Creek quarry and the extensive metamorphism of the Triassic limestone conglomerate at Leesburg. E. V. Shannon, of the National Museum, E. Sampson, of the Geological Survey, and E. T. Wherry, president of the Mineralogical Society, acted as guides.

Miss KATHERINE D. KIMBALL, assistant in the Grass Herbarium of the Department of Agriculture, was killed by an automobile January 12. Miss Kimball had been connected with the Department about five years.

Dr. WILLIAM M. MANN, of the Federal Horticultural Board, returned January 14 from Mexico, where he has been studying the fruit fly situation. Dr. Mann left early this month on an extended trip to Colombia, Costa Rica, and Guatemala.

On January 12 Dr. WILLIAM BOWIE, Chief of the Division of Geodesy of the U. S. Coast and Geodetic Survey, gave a lecture before the Royal Canadian Institute of Toronto, Canada, *What do we know about the Earth's crust?*

The January, 1924, number of the Geographical Journal, (London) contains two articles on isostasy; one is by Dr. William Bowie, Chief of the Division of Geodesy of the U. S. Coast and Geodetic Survey, entitled *Abnormal densities in the Earth's crust disclosed by analysis of geodetic data*, and the other by Capt. ALBERTO ALESSIO, Hydrographer of the Italian Navy, entitled *Doubts and suggestions on terrestrial isostasy.* These two papers were read at a meeting of the Royal Geographical Society of Great Britain, at a meeting on November 12, 1923, and were followed by discussions, printed after the articles, by eminent English scientists. The printed discussions were by Prof. Arthur R. Hinks, Sir Frank Dyson, G. W. Lamplugh, Dr. Morley Davies, Sir Sidney Burrard, R. D. Oldham, Sir Charles Close, Colonel Crosthwait, Dr. J. W. Evans and Dr. Harold Jeffreys.

J. S. DILLER, who has held an appointment as geologist on the Geological Survey for more than forty years, retired from the government service on December 31.

An expedition, headed by RICHARD O. MARSH of Brockport, N. Y., sailed January 12 for Panama, for the purpose of studying a tribe of blonde Indians said to inhabit the Chucunaque Valley in the eastern part of that republic, and of carrying on general scientific exploration. Other members of the party are JOHN L. BAER, of the National Museum, anthropologist, H. L. FAIRCHILD, of the University of Rochester, geologist, and Dr. C. BREDER, of the American Museum of Natural History, ichthyologist. All physical data and specimens of ethnological, archaeological, or anthropological nature collected by the expedition are to become the property of the National

Museum. It is expected that a detail of topographers and engineers from the Engineering Corps will accompany the party, and that airplanes will be used for transportation from the Zone into the interior.

The Petrologists' Club met on January 15 at the home of F. E. Wright. Dr. T. A. Jaggar, of the Volcano Observatory, Hawaii, spoke on *Lava tides*. The following officers were elected for the year: Governing Committee, C. N. FENNER, C. S. ROSS, E. V. SHANNON; Secretary-Treasurer, E. B. SAMPSON.

Dr. H. W. GILLETT, who has been engaged in research on alloys at the Ithaca station of the Bureau of Mines, has been appointed chief metallurgist of the Bureau of Standards, succeeding Dr. G. K. Burgess who is now director of the Bureau.

Dr. T. WAYLAND VAUGHAN, formerly of the Geological Survey, left Washington January 20 to take up his work as director of the Scripps Institute of Biological Research at La Jolla, California.

WOODROW WILSON, the most distinguished member of the ACADEMY, twenty-eighth President of the United States, died February 3. Mr. Wilson was elected an honorary member of the ACADEMY March 5, 1918, in view of his contribution to the science of history.